

SOME SPECIES OF *CULEX* (*LOPHOCERAOMYIA*) FROM NEW GUINEA AND ADJACENT ISLANDS, WITH DESCRIPTIONS OF FOUR NEW SPECIES AND NOTES ON THE MALE OF *CULEX FRAUDATRIX* THEOBALD. (DIPTERA: CULICIDAE.)

By DONALD H. COLLESS, Department of Parasitology, University of Malaya.

(Three Text-figures.)

[Read 25th November, 1959.]

During studies of the Malayan members of the genus *Culex*, subgenus *Lophoceraomyia*, it has become obvious that certain species, in particular *C. fraudatrix*, have been consistently misidentified from many countries; apart from references to the type specimens, practically every published record of this latter species is now of doubtful validity. However, studies of type material held in the British Museum (Natural History) and several collections of material from New Guinea, the type-area of *C. fraudatrix*, now make it possible to define more accurately the taxonomic characters of the latter species, while a number of new species and locality records have also come to light, as described below.

In this subgenus, male specimens are readily identified, principally by features of the antennal scale tufts and the terminalia. In particular, the scale tuft on antennal segment 6 (counting the torus as segment 1) and the dorsal submarginal setae on the coxite serve to identify most species; additional useful characters are found in the setae and basal processes of the palps, the dorsal setae of the proboscis, and, on the coxite, the shape of the dorsal margin and the processes of the subapical lobe. The presence of abdominal banding and pleural scales may also be diagnostic in both sexes. The females, however, are often difficult, and sometimes impossible, to identify with existing criteria. For accurate definition of their taxonomy, one must work back from the male, either through the larva, or directly from siblings reared from single egg rafts. The larvae of many species are not well defined as yet, and some are probably difficult to identify, but, in Malaya at least, most species can be identified in this stage, using the usual characters. The branching of the larval prothoracic hairs is a very useful character in this subgenus, and it is to be regretted that many extant descriptions neglect to mention these hairs.

In describing the male terminalia, I have omitted any mention of the paraprocts, since these present a variety of appearances with only slight alterations in viewing position. Characters of the male antennae are described mainly from slide preparations, which are essential for observing the finer details, and segment numbers follow the usual convention in which the torus is counted as segment 1. In numbering palp segments, the long central segment is No. 3, while the junction of segments 1 and 2 is visible usually just beyond the apices of the basal processes (Fig. 1a).*

CULEX (L.) *FRAUDATRIX* Theobald, 1905.

Theobald, F. V., 1905: *Ann. Mus. Nat. Hung.*, 3: 94.

Types: Holotype male and presumed paratype male from the National Museum of Hungary, at present on loan in the British Museum (Natural History).

Type Locality: Friedrich-Wilhelmshafen, New Guinea.

* Since writing the above, I have found that this numbering is incorrect; also that very useful characters occur on the paraprocts. These points will be discussed in a future publication.

MALE: The following description is based on the type series, and a number of additional specimens, almost certainly of this species, from New Guinea, New Britain, and New Ireland.

Head. Vertex with dark upright scales, the recumbent scales fine and pale-brown on a triangular central area, broad and pale laterally, with a border of broad, rather grey scales around the eye margins. Proboscis (Fig. 1a) dark, with a double row of hairs dorsally on the apical half, many of these with rather sigmoid curvature and about twice as long as the proboscis is wide; also, a number of forward-slanting hairs ventrally on the apical third, and a transverse row of short, stiff bristles near the extreme base. Palps (Fig. 1a) longer than proboscis by rather more than the length of the terminal segment, each with a pair of basal processes of which only the outer members are visible from above. Seg. 3 with short fine ventral hairs, massed near the base and absent from near the apex, and a tuft of much longer hairs ventro-laterally on the basal half. Segs. 4 and 5 profusely clad with long hairs.

Antenna. Seg. 6 (Fig. 1b) with prominent tuft of 15–20 scales, most of them about the same length and about as long as the next 4–5 antennal segments; the most dorsal (internal) 5–8 scales dark with blunt apices, the more ventral ones with fine pointed apices and with an increasing length of apical pale coloration; these more ventral scales rather variable in shape, from near-lanceolate to very elongate with long fine parallel-sided tip. Seg. 7 with large external tuft of strong twisted setae, and internal tuft of similar straight setae. Seg. 8 with small, rather comb-like external tuft of twisted setae, and internal tuft of very broad setae, twisted at their apices. Seg. 9 with several short setae externally, and an internal tuft of long sigmoid setae, apparently fused basally. Seg. 10 with external tuft of about 4 long, blade-like leaflets, with fine, abruptly tapered apices, and internal tuft of 5–10 shorter setae. Seg. 11 with internal tuft of about 6 relatively short stout setae.

Thorax. Integument deep brown, with sparse fine brown recumbent scales. Pleurae without scales.

Legs uniformly brown-scaled, except on the under-surfaces of the femora, which are pale.

Wing. Branches of vein 2 with rather broad clavate scales. Fork of vein 2 a little distal to that of vein 4.

Abdomen. Uniformly brown-scaled, unornamented.

Terminalia: Coxite (Fig. 2e) with dorsal margin slightly convex on the basal half, with marginal row of 5–6 setae, and, a little inside these on the external surface, 3 long prominent setae with curved apices, their bases forming a triangle and *not a straight line*; occasionally there may be 2 or 4 setae, on one side only. Subapical lobe (Fig. 2f) with three strong, rod-like processes with expanded and/or hooked tips, 5–6 short, blade-like processes, and two clavate leaflets, the external one with longitudinal striations. Lateral plate of phallosome with long pointed process, curved at approximately 90 degrees, the posterior angle usually with several very small teeth. Ninth tergite with 2–4 very short setae.

FEMALE and LARVA: Not yet known.

Specimens Seen: New Guinea: Friedrich-Wilhelmshafen, 2♂♂ (type series); Wewak, 1♂; Sauri, 1♂; Vanimo, 1♂. New Britain: Pondo, 3♂♂. New Ireland: Kavieng, 2♂♂. I have also briefly examined specimens from North Queensland, Australia, which almost certainly belong to this species.

Identification: The unornamented thorax and abdomen, together with the large tuft of 15–20 long scales on antennal segment 6, distinguishes *C. fraudatrix* from all other members of the subgenus found in New Guinea, while finer details of shape and relative length of the more ventral scales in the tuft distinguish it from closely related species found in the Oriental region; these latter are to be described in a future publication. The non-linear arrangement of the dorsal, submarginal setae on the coxite also distinguishes *C. fraudatrix* from all but *C. atracus*, n. sp.

Notes: The type specimens of *C. fraudatrix* are rather badly damaged. In particular, the holotype lacks palps and antennae, but there is a topotypical paratype

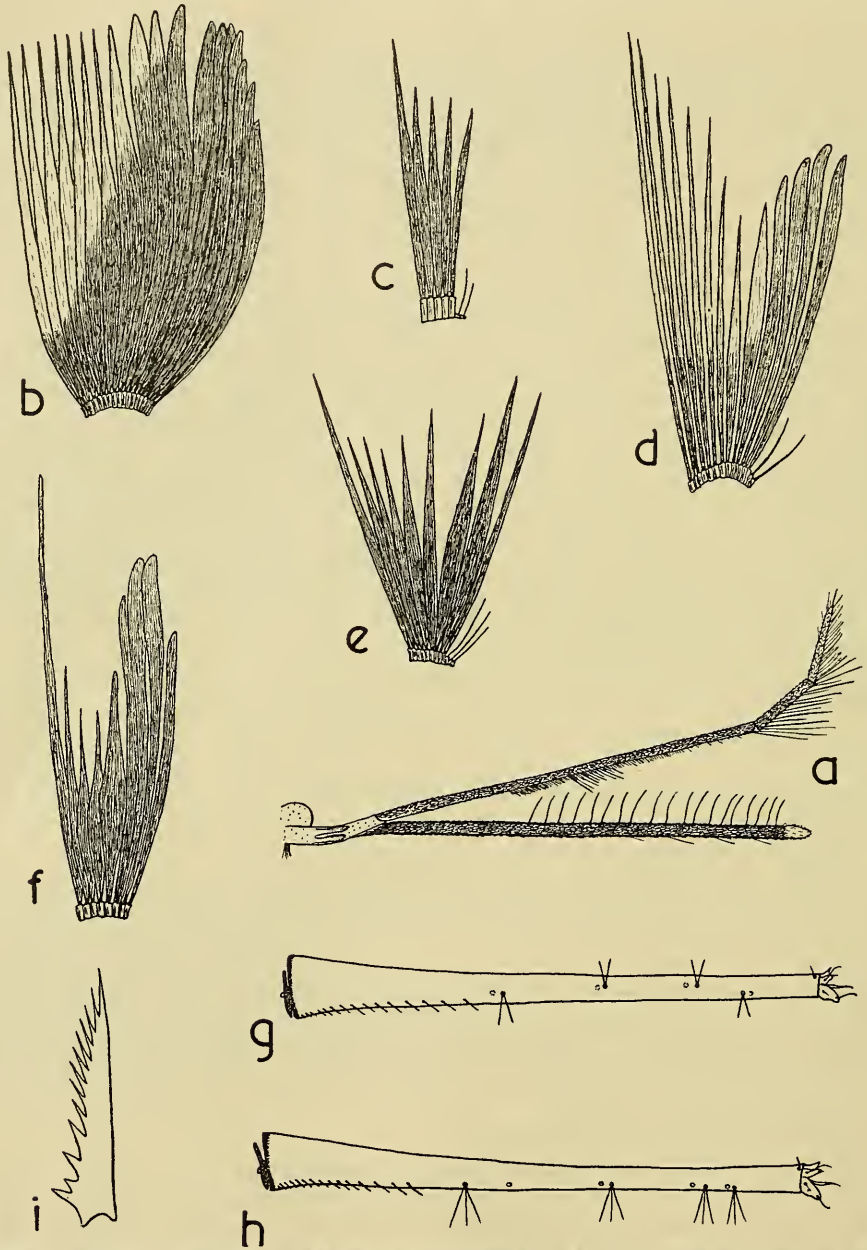


Fig. 1.—(a) *C. fraudatrix*, male palp and proboscis. (b) to (f) Scale tufts from seg. 6 of male antennae, dorsal scales to right: (b) *C. fraudatrix*; (c) *C. pseudornatus*, n. sp.; (d) *C. petersi*, n. sp.; (e) *C. atracus*, n. sp.; (f) *C. christiani*, n. sp. (g), (h) Larval siphons: (g) *C. petersi*, n. sp.; (h) *C. christiani*, n. sp. (i) Larval pecten tooth, *C. petersi*, n. sp.

which possesses antennae and most of one palp; its terminalia are identical with those of the holotype and there seems no doubt that the two are conspecific. However, this paratype does not show the ventro-lateral tuft of long hairs near the base of palp segment 3, seen in other undamaged specimens, but I feel that this is almost certainly

due to loss of the hairs by rubbing. In all other important characters, the specimens described above appear to be conspecific with the type, the variation seen being probably of geographic origin. As regards the latter point, it is worth noting that the specimens from New Britain and New Ireland do seem to differ from the type in one small detail; the setae near the centre of the external surface of the coxite tend to be a little longer than in specimens from New Guinea. Also, in one specimen from Kavieng and one from Pondo, the submarginal setae were placed almost in line.

It is hoped that the above description will serve to clarify the position as to the range of this species, which has been erroneously identified from many areas away from New Guinea. Examination of collections from the Oriental Region provides no evidence of its occurrence here, and it quite certainly does not occur in Malaya. Its range in other parts of the Australasian Region and Eastern Indonesia remains to be worked out. Likewise, the characters of the female and immature stages remain to be described, by correlation with known males.

With the exception of the types, all specimens described are to be returned to the School of Public Health and Tropical Medicine, Sydney.

CULEX (L.) ATRACUS, n. sp.

Types: Holotype and one paratype, both males, to be placed in the British Museum (Natural History); 7 paratype males to be returned to the School of Public Health and Tropical Medicine, Sydney; 2 paratype males to be placed in the United States National Museum.

Type Locality: Kavieng, New Ireland.

MALE: Very similar to *C. fraudatrix*, with apparently identical terminalia (Fig. 3c), but differing as follows: *Palp*: Seg. 3 with the tuft of ventro-lateral hairs usually not so well developed, often not apparent. *Antenna*: Seg. 6 (Fig. 1e) with tuft of 7-10 dark, fine-pointed scales, the longest about as long as the next 4 segments; relative lengths rather variable, but the first or second most dorsal and/or the most ventral usually longer and often narrower than the others; also, dorsal to the scales, 2-4 small setae.

FEMALE and LARVA: Not yet known.

Specimens Seen: New Britain: Keravat, 3♂♂. New Ireland: Kavieng, 8♂♂.

Identification: The form of the tuft on antennal segment 6, together with the *fraudatrix*-like terminalia, clearly differentiates this species from all other members of the subgenus.

Notes: The form of the terminalia suggests that *C. atracus* is closely related to *C. fraudatrix*, although this is not borne out by characters of the antenna. In the latter feature, there are distinct resemblances to several Malayan species, though present records suggest that *C. atracus* is confined in its distribution to the islands east of New Guinea.

CULEX (L.) SP. A-2 near *fraudatrix* Theo.

A single male specimen appears to belong to a rather rare Malayan species, closely related to *C. fraudatrix*. The code name used above is that in current use in studies of the Malayan fauna, and will be referred to when the latter are published. It is rather surprising to find this species amongst New Guinea material, but the identification seems to be correct, due to certain very distinctive features of the terminalia and antenna. These are described below.

MALE: Very similar to *C. fraudatrix*, but differing as follows: *Palp*: Seg. 3 with the short ventral hairs scanty, more or less confined to the basal half, not forming a ventro-lateral tuft; basal processes shorter and finer than in *fraudatrix*. *Antenna*: Tuft on seg. 6 with several lanceolate scales at about the centre, these about half as long as the more dorsal scales. *Terminalia*: Coxite (Fig. 2c) with more pronounced convexity on the basal half of the dorsal margin, and the three submarginal setae with their bases placed in a straight line. Subapical lobe (Fig. 2d): the most external of the

three rod-like processes with a pronounced "elbowed" curvature, the most internal one also rather "elbowed", and more expanded apically.

Specimens Seen: New Guinea: Vanimo, 1♂.

CULEX (L.) ORNATUS (Theobald), 1905.

Theobald, F. V., 1905: *Ann. Mus. Nat. Hung.*, 3: 100 (*Melanoconion ornatus*).

I have seen two specimens which agree well with the description of this species given by King and Hoogstraal (1955). The ornamentation of thorax and abdomen, the scaling of the pleurae, and the male terminalia are all particularly distinctive. The following characters may be noted as additional to, or differing slightly from, those described by King and Hoogstraal:

MALE:

Palp: Seg. 3 as in *C. fraudatrix*, the ventro-lateral tuft very conspicuous, its hairs about $\frac{1}{4}$ the length of the segment; basal processes well developed. *Proboscis* with double row of rather short hairs dorsally on the apical half, the longest (towards the apex) being scarcely longer than the width of the proboscis. *Propleural hairs* profuse, more than 20 in number (similar in the female). *Terminalia*: Style with apical crest of fine chitinous ridges, not setae, continuing back a little past the true seta. Subapical lobe with one of the stout processes of the basal lobule much more expanded than the other two, almost leaflet-like, with truncate apex drawn out into two sharp points.

Specimens Seen: New Guinea: Aitape, 1♂. New Britain: Keravat, 1♀.

CULEX (L.) PSEUDORNATUS, n. sp.

Types: Holotype male and allotype female to be placed in the British Museum (Natural History); paratype male and female to be returned to the School of Public Health and Tropical Medicine, Sydney.

Type Locality: Edie Creek, New Guinea.

MALE:

Vertex with upright scales mainly pale golden-brown, some of the more lateral ones dark; recumbent scales fine and pale on the central third, broad and dark external to these, and broad and pale at the extreme lateral corners; the latter scales extend inwards to form a pale margin around the eyes.

Proboscis and palps resembling those of *C. fraudatrix*, but the dorsal hairs of the proboscis extend well onto the basal half; also, palp without any ventro-lateral hair tuft on seg. 3, and with rather shorter basal processes.

Antennal seg. 6 (Fig. 1c) with rather inconspicuous tuft of about 5 dark pointed scales, preceded dorsally by 2-3 short setae. The length of the scales increases ventrally, the most ventral one about as long as the next 3 segments. Other segments as in *C. fraudatrix*.

Thoracic integument brown, largely clothed with fine pale scales, which form a pattern rather similar to that seen in *C. ornatus*; as follows: one broad pale central longitudinal band, extending back over about the anterior half, and two lateral pale bands, which curve around, and to some extent across, the fossae and extend back, around the prescutellar bare space, to the scutellum; on the anterior two-thirds, the pale bands are separated by two longitudinal dark lines of unsealed integument. All lobes of the scutellum with narrow pale scales. Pleura with a small patch of pale scales at the dorsal angle of the sternopleuron.

Wing with rather broad scales on the branches of vein 2; bases of the fork cells level.

Abdomen with broad basal pale bands on tergites II-VII. Venter pale-scaled.

Legs uniformly dark, except for the femora which are pale on their under-surfaces, the hind-femora being largely pale on the basal half.

Terminalia: Coxite (Fig. 2a) with dorsal margin only slightly sigmoid, with numerous short setae placed in 3-4 rows, and, internal to these, a submarginal row of 5-7 long, sharply-curved setae. Subapical lobe with the usual 3 rod-like processes on

the basal lobule, their apices not markedly expanded; the distal lobule with 2 clear, clavate leaflets, and 2 setae, one strong and one fine. Lateral process of phallosome (Fig. 2b) resembling that of *C. fraudatrix*, but posterior angle of the median process more produced, with more numerous teeth. Ninth tergite with 7-10 rather prominent setae, about $\frac{1}{3}$ - $\frac{1}{2}$ the length of the paraproct.

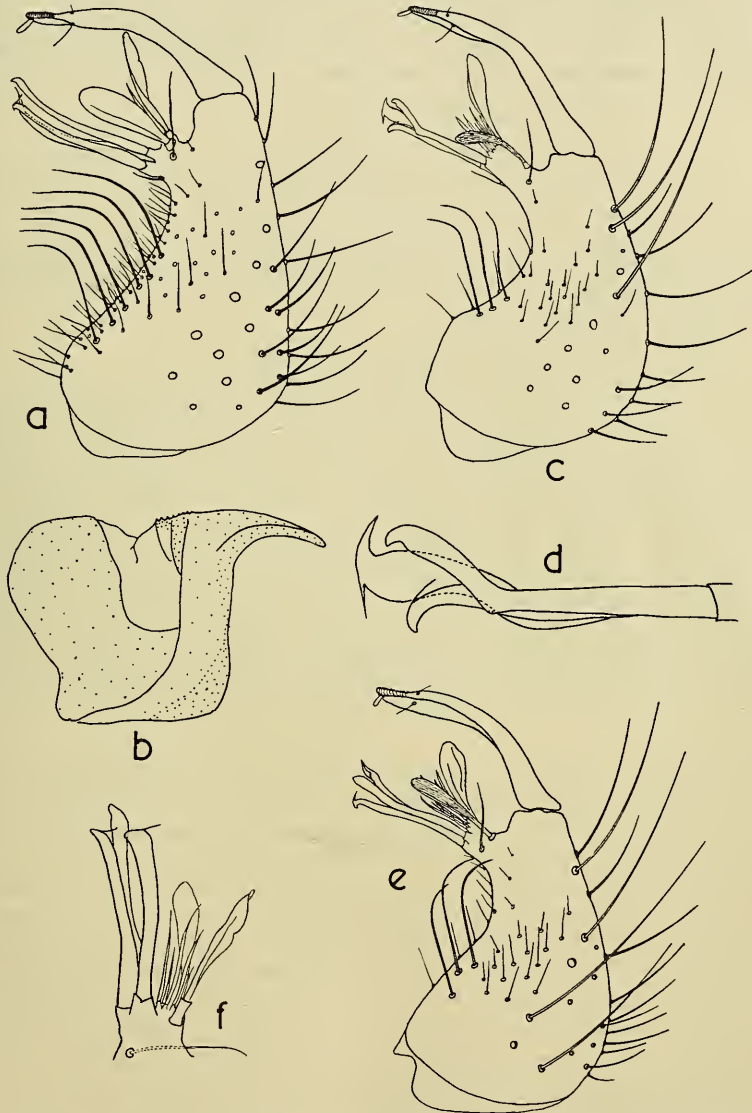


Fig. 2.—(a), (b) *C. pseudornatus*, n. sp.: (a) coxite; (b) right half of phallosome, lateral external view. (c), (d) *C. sp. A.2* near *fraudatrix*: (c) coxite; (d) rod-like processes of subapical lobe. (e), (f) *C. fraudatrix*: (e) coxite; (f) subapical lobe.

FEMALE:

Ornamentation as described for the male; one specimen with rather more brown scaling in the fossae, the other with the scutum mainly pale-scaled on the anterior half.

LARVA: Not seen.

Identification: The thoracic ornamentation separates this species from all but *C. ornatus*, and *C. christiani*, n. sp., from which it is distinguished by the complete

abdominal bands, the small scale-tuft on antennal segment 6, and various features of the male terminalia, palps, and proboscis.

Specimens Seen: Type series only.

Notes: The ornamentation and, to some extent, the characters of the terminalia, suggest a relationship between this species and *C. ornatus*, but there are marked differences in antennal characters. A similar situation is seen in other pairs of apparently related species (e.g., see under *C. atracus*), which suggests that the structures of segment 6 of the male antenna may alter relatively rapidly under evolutionary pressure, in its broadest sense. In this case, known distributions suggest that *C. ornatus* is coastal and *C. pseudornatus* a highland form.

CULEX (L.) PETERSI, n. sp.

Types: Holotype male and allotype female, both with correlated larval and pupal skins, and 1 morphotype larva to be placed in the British Museum (Natural History); paratype male and female, both with correlated larval and pupal skins, and 1 morphotype larva to be placed in the School of Public Health and Tropical Medicine Sydney; paratype male and female, both with correlated larval and pupal skins, to be placed in the United States National Museum.

Type Locality: Minj, Western Highlands, New Guinea.

MALE: Generally similar to *C. fraudatrix*, differing as follows: *Palp*: Seg. 3 with sparser ventral hairs and no ventro-lateral tuft; basal processes longer, their apices almost level with apex of palp segment 1. *Antenna*: Scale tuft on seg. 6 (Fig. 1*d*) with 3-4 dark, blunt-tipped scales dorsally, these about as long as the next 4 segments, then several shorter lanceolate scales and a series of 8-10 very narrow pointed scales of increasing length; the latter, and sometimes the lanceolate scales, pale on the apical half or more; also, dorsal to the scales, several short setae. *Terminalia*: Coxite (Fig. 3*d*) rather resembling that of *C. fraudatrix*, but the 3 submarginal setae with their bases in line, and the most basal one rather weak and straight. Subapical lobe (Fig. 3*e*) with 3 rod-like processes as figured, apical lobule with 2 leaflets, the external one truncate apically; also 6 shorter processes, 3 curved, 1 straight, 1 curved with serrate margin, and 1 with apex expanded and then narrowing abruptly to a fine tip. Lateral plate of phallosome rather similar to that of *C. pseudornatus*. Ninth tergite with 3-6 short setae.

FEMALE: Resembles the male in ornamentation, but the more posterior abdominal tergites with small, indistinct, lateral pale spots. Scutum uniformly brown-scaled.

LARVA: Antenna dark at the extreme base and on the portion distal to the tuft. Shaft spiculate dorsally, externally, and ventrally near the base; a few spicules laterally, distal to the tuft. Apical bristle with apex almost level with those of the subapical bristles. Clypeal spines fairly stout, dark. Mentum with 7-9 teeth each side of the large central tooth, the most lateral ones very small. Head hairs: No. 7, 8-11-branched; Nos. 5 and 6 bifid; No. 4, 2-3-branched, about as long as the distance between its base and that of hair No. 5; No. 8, 3-5-branched; No. 9, 6-8-branched.

Thorax lightly spiculate on dorsal and ventral surfaces. Prothoracic hairs 1, 2, 4, 5, and 6 all single; hair 3 single or bifid, short; hair 7, 3-branched; hair 8, 2-3-branched.

Upper lateral hairs 3-branched on abdominal segs. I-III, 3-5-branched on the other segments. Pentad hairs: No. 1, 5-branched; No. 2, usually bifid, rarely single; No. 3, 8-branched; No. 4, single; No. 5, 4-5-branched. Lateral comb of about 50 elongate scales, with rounded apices and complete fringe.

Siphon (Fig. 1*g*) with prominent acus; index 6.6-8.1 (in 3 whole larvae); siphon/saddle ratio 4.1-4.5, mean 4.3. Tufts 1-3-branched, usually bifid, and about as long as the width of the siphon; 8-9 in number and rather regularly paired, the two central pairs placed laterally, contrasting markedly with the near-ventral apical pair. Pecten of 13-15 spines (Fig. 1*i*), with even fringe grading to fairly strong basal denticles.

Saddle completely encircling anal segment, with lightly spiculate posterior border; ventral brush with 12 tufts; saddle hair 2-3-branched; *isc.* 3-4-branched; papillae more than twice as long as saddle, strongly tapered to fine rounded apices.

Specimens Seen: Type series only.

Identification: *C. petersi* is distinguished mainly by the form of the scale-tuft on antennal segment 6 of the male; also by characters of the terminalia, in particular, the truncate leaflet on the subapical lobe of the coxite. The larva cannot be distinguished with any certainty from those of *C. leei*, *C. ornatus*, or *C. marksae*, on the basis of published descriptions, while differences from *C. christiani*, n. sp., are described below.

Notes: The type series was bred from larvae taken in shallow pools with emergent vegetation, at an altitude of 5,140 feet (coll. S. H. Christian). The species is dedicated to Dr W. Peters of the New Guinea Department of Public Health.

CULEX (L.) CHRISTIANI, n. sp.

Types: Holotype male and allotype female, both with correlated larval and pupal skins, and a series of morphotype larvae to be placed in the British Museum (Natural History); male paratype with correlated larval and pupal skins, and a series of morphotype larvae to be placed in the School of Public Health and Tropical Medicine, Sydney; a similar series to be placed in the United States National Museum.

Type Locality: Minj, Western Highlands, New Guinea.

MALE: Resembles *C. petersi*, differing as follows: *Antenna:* Seg. 6 (Fig. 1f) with scales all dark, the more dorsal 4-5 broad and blunt-tipped, followed by 3-4 shorter pointed scales, and then several very narrow scales with long fine tips of increasing length; the latter grade into the long ventral setae. *Thorax* with indistinct pattern of the type described below for the female; pale scaling only clearly apparent at the anterior margin of the scutum and on the scutellum, but the pair of submedian bare lines is obvious. *Abdominal tergites* with basal pale bands of moderate width (see notes below). *Terminalia:* Coxite (Fig. 3a) rather resembling that of *C. pseudornatus*, with numerous short setae on the dorsal margin, but with a submarginal row of only 3-5 long curved setae, the basal one rather weak. Subapical lobe (Fig. 3b) with the usual 3 rod-like processes, and, on the distal lobule, 2 clear clavate leaflets and 6 shorter processes, one of them expanded apically and one curved with a serrate margin (the serrations may not always be apparent).

FEMALE: Ornamentation of head and thorax similar to that described for *C. pseudornatus*, but rather reduced, and with darker integument; in particular, the pale scaling is virtually absent over and around the fossae. Sternopleuron with only 1-2 small pale scales along posterior border.

LARVA: Very similar to that of *C. petersi*, but differing as follows: *Antenna* more deeply pigmented on the central region of the shaft. *Prothoracic hair* 4 with 2 branches. *Pentad hair* 2 unbranched. *Siphon* (Fig. 1h) a little longer—index 9.0-9.4 (in 7 whole larvae); siphon/saddle ratio 4.1-5.3, mean 4.8. *Siphon tufts* (Fig. 1h) 3-5-branched, usually 3- or 4-branched; usually less regularly paired, and all similarly ventro-lateral in position.

Specimens Seen: Type series only.

Identification: In both sexes, the ornamentation of the thorax distinguishes *C. christiani* from all but *pseudornatus* and *ornatus*, from which it is separated by the absence of any definite scale patch on the pleurae. The male antenna and terminalia are also characteristic. Existing descriptions of larvae allow comparison only with *C. kuhnsi*, which has a highly spiculate integument, while differences from *C. petersi* are given above.

Notes: The abdomen is described above as possessing basal pale bands. However, this was observed in only a single male specimen. In the remainder, such bands were not seen, but I am reasonably certain that this was due to shrivelling of the abdomens of the specimens concerned. The specimen showing definite bands has been selected as holotype.

On adult characters, *C. christiani* seems most closely related to *C. pseudornatus*, and, like it, seems to be a highland form. The type series was bred from larvae taken in the same pools as the series of *C. petersi*.

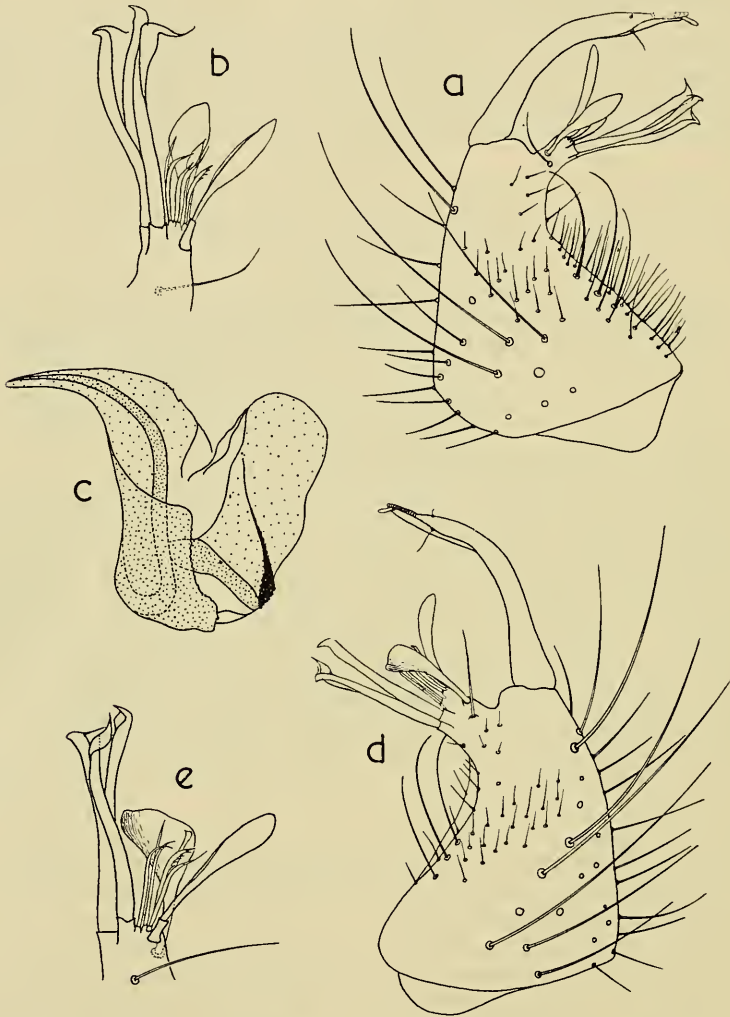


Fig. 3.—(a), (b) *C. christiani*, n. sp.: (a) coxite; (b) subapical lobe. (c) *C. atracus*, n. sp., right half of phallosome, lateral internal view. (d), (e) *C. petersi*, n. sp.: (d) coxite; (e) subapical lobe.

The species is dedicated to the collector, Mr S. H. Christian, of the New Guinea Department of Public Health.

Acknowledgements.

I am deeply indebted to Dr W. Peters and Mr S. H. Christian, of the Department of Public Health, Territory of Papua and New Guinea, and to Mr D. J. Lee, of the School of Public Health and Tropical Medicine, Sydney, for the gift or loan of specimens from New Guinea; also to Mr P. F. Mattingly, of the British Museum (Natural History), for information concerning the type specimens of *C. fraudatrix*.

Reference.

KING, W. V., and HOOGSTRAAL, H., 1955.—Three new species of New Guinea *Culex*, subgenus *Lophoceromyia*, with notes on other species. *Proc. ent. Soc. Wash.*, 57: 1.